New Orleans, La., on the 27th and 28th. The Ohio River was 5.7 feet above the danger point at Cincinnati, Ohio, on the 28th, and 7.6 feet above at Louisville, Ky., on the same date. The Cumberland River was 3.4 feet above the danger point at Nashville, Tenn., on the 28th. The Tennessee River was 1.8 foot above the danger point at Chattanooga, Tenn., on the 28th. The Willamette River was 13.7 feet above the danger point at Portland, Oregon, on the 5th.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Sault de Ste. Marie, Mich., 14th: an auroral display was observed at 9.40 p. m., consisting of a well-defined arch of yellowish light which rose to about altitude 40°. The arch extended between north and northeast, and the maximum brilliancy of the aurora occurred at 10.50 p. m., after which the arch gradually disappeared, and at 11.20 p. m. the display had entirely vanished.

Marquette, Mich., 14th: an auroral display, consisting of a dark segment which rose about twenty-five degrees above the horizon, and also of an arch of pure white light which extended from northwest to northeast, was observed in the evening.

Auroras were observed during the month as follows: 1st, Orono, Me. 6th, Wapeton, N. Dak. 11th, Cresco, Iowa; Eastport and Orono, Me.; Leech Farm, N. Dak.; Webster, S. Dak. 13th, Orono, Me. 14th, Cresco, Iowa; Marquette and Sault de Ste. Marie, Mich.; Leech Farm, N. Dak.; Greenwood, Wis. 15th, Lewiston, Pa. 18th, Manitowoc, Wis. 20th, Montevideo, Minn.

THUNDER-STORMS.

The more severe thunder-storms of the month are described under "Local storms". East of the Rocky Mountains thunder-storms were reported in the greatest number of states and territories, twenty-four, on the 25th; in twenty on the 24th; in sixteen on the 26th; in fifteen on the 18th; in fourteen on the 19th and 28th; in from five to eleven, inclusive, on the 3d, 4th, 6th, 7th, 8th, 13th, 14th, 17th, 20th, 23d, and 27th; and in from one to three, inclusive, on the 1st, 2d, 9th to 12th, 21st, 22d. The 5th, 15th, and 16th were the only dates on which no thunder-storms were reported east of the Rocky Mountains.

East of the Rocky Mountains thunder-storms were reported on the greatest number of dates, twelve, in Louisiana, Mississippi, Pennsylvania, and Texas; on eleven dates in Tennessee; on ten dates in Alabama, Arkansas, and Illinois; on from five to nine dates, inclusive, in Florida, Georgia, Indiana, Kentucky, Maryland, Michigan, Missouri, New Jersey, New York, North Carolina, Ohio, South Carolina, Virginia, and West Virginia; and on one or two dates in Connecticut, District of Columbia, Indian Territory, Iowa, Kansas, Massachusetts, Minnesota, Rhode Island, and Wisconsin. In states and territories east of the Rocky Mountains other than those named, no thunder-storms were reported. The only states west of the Rocky Mountains reporting thunder-storms were: California, 16th and 19th; New Mexico, 6th and 26th; and Utah 26th.

MISCELLANEOUS PHENOMENA.

HALOS.

Solar and lunar halos were reported in New England and the middle Atlantic states on twenty-five dates. On twenty-four dates rain or snow fell in that region on the dates for which halos were reported; on twenty-two dates on the second day; and on twenty dates on the third day following the halos. In the south Atlantic states halos were reported on fifteen dates. On thirteen dates rain fell on the dates for which halos were reported; on ten dates on the second day; and on eight dates on the third day following the halos. In the Lake region halos were reported for twenty-two dates. On nineteen dates rain or snow fell on the dates for which halos were reported; on seventeen dates on the second day; and on fifteen dates on the third following the halos. In the Mississippi and Ohio valleys halos were reported on twenty-three dates. On eighteen dates rain or snow fell on dates for which the halos were reported; on seventeen dates on the second day; and on seventeen dates on the third day following the halos. In the Gulf states halos were reported on eight dates. On eight dates rain fell on the dates for which the halos were reported; on five dates on the second day; and on seven dates on the third day following the halos. In the Rocky Mountain and plateau regions halos were reported on eight dates. On six dates rain or snow fell on the days for which the halos were reported; on six dates on the second day; and on six dates on the third day following the halos. In the Missouri Valley halos were reported on twenty dates. On sixteen dates rain or snow fell on the days for which halos were reported; on thirteen dates on the second day; and on ten dates on the third day following the halos. On the Pacific coast halos were reported on seventeen dates. On fourteen dates rain fell on the dates for which halos were reported; on fourteen dates on the second day; and on fourteen dates on the third day following the halos.

The above statement shows that in New England and the middle Atlantic states 96 per cent. of the halos were attended by rain or snow in the regions referred to on the same date; 89 per cent. were followed on the second day, and 80 per cent. on the third day by rain or snow. In the south Atlantic states 87 per cent. of the halos were attended by rain on the same date; 67 per cent. were followed on the second day, and 53 per cent. on the third day by rain. In the Lake region 86 per cent. of the halos were attended by rain or snow on the same day; 77 per cent. were followed on the second day, and 68 per cent. on the third day by rain or snow. In the Mississippi and Ohio valleys 78 per cent. of the halos were attended by rain or snow on the same day, and 74 per cent. were followed on the second and third days by rain or snow. In the Gulf States 100 per cent. of the halos were attended by rain on the first day; 63 per cent. were followed on the second day, and 87 per cent. on the third day by rain. In the Rocky Mountain and plateau regions 78 per cent. of the halos were attended by rain or snow on the same day, and 78 per cent. were followed on the second and third days by rain or snow. In the Missouri Valley 80 per cent. of the halos were attended by rain or snow on the same day; 65 per cent. were followed on the second day, and 50 per cent. on the third day by rain or snow. On the Pacific coast 82 per cent. of the halos were attended by rain or snow on the same day, and 82 per cent. were followed on the second and third days by rain or snow. It is also shown that in New England and the middle Atlantic states 64 per cent. of the halos occurred in the eastern quadrants of low pressure storms, and 36 per cent. following the passage of areas of low pressure or within areas of high pressure. In the south Atlantic states 53 per cent. of the halos occurred in the eastern quadrants and 47 per cent. in the western quadrants of low pressure storms. In the Lake region 59 per cent. of the halos occurred in the eastern quadrants and 41 per cent. in the western quadrants of low pressure storms. In the Mississippi and Ohio valleys 56 per cent. of the halos occurred in the eastern quadrants and 44 per cent.

in the western quadrants of low pressure storms. In the Gulf States 87 per cent. of the halos occurred in the eastern quadrants and 13 per cent. in the western quadrants of low pressure storms. In the Rocky Mountain and plateau regions 37 per cent. of the halos occurred in the eastern quadrants and 63 per cent. in the western quadrants of low pressure storms. In the Missouri Valley 65 per cent. of the halos occurred in the eastern quadrants, and 35 per cent. in the western quadrants of low pressure storms. On the Pacific coast 24 per cent. of the halos occurred in the eastern quadrants, and 76 per cent. in the western quadrants of low pressure storms.

From the above it appears that during February, 1890, halos occurred within the influence of low pressure storms or attending the disturbed atmospheric conditions that attended the passage of general storms; 86 per cent. of the halos were attended by rain on the same day. In regions east of the Rocky Mountains 64 per cent. of the halos were noted in the eastern quadrants, and 36 per cent. of the halos were noted to the westward of low pressure storms. In the Rocky Mountain and plateau regions but 31 per cent. of the halos were noted in the eastern quadrants of low pressure storms, and 69 per cent. of the halos reported in those regions occurred attending or following the passage of low pressure storms over the Rocky Mountain and plateau regions.

PARHELIA.

Milwaukee, Wis.: well defined parhelia were observed from noon to 3 p. m., 16th. They were brightest at 2 p. m., the sky being partly covered with cirro-stratus clouds, with haze in the upper atmosphere. Four mock suns were well defined, two on each side of the sun. The largest circle, which passed through the sun and reached to within 30° of the northern horizon, was of a whitish light, very bright, and well defined. The other circles exhibited the prismatic hues, the red on the inside or towards the sun. Mock suns were also observed at 6.20 p. m., 28th, when the sun was several degrees above the western horizon. On a line with the sun, and on each side, north and south, equally distant about 20° from the sun, were very bright spots exhibiting prismatic colors, with the red tint towards the sun. The western sky was covered at the time with broken masses of stratus and cirro-stratus clouds. On the morning of the 16th a low pressure storm of slight energy was central over the northern part of the Lake region and low pressure storms were central on the evening of that date, one over Iowa and the other over Kansas. No rain fell in the Lake region on the 16th, but was general in that section on the 17th and 18th. On the 28th a low pressure storm of considerable energy moved northeastward from the lower lake region.

Era, Idaho: on the morning of the 25th the atmosphere was filled with floating particles of frost, and as the sun rose two fan-shaped sun-dogs appeared, one on each side of the sun. They were of unusual brilliancy, the one in the north being much the brighter. The colors of the rainbow were displayed with sparkling brilliancy, and coruscating streamers were thrown out, causing the display to resemble a miniature aurora borealis. Before the sun-dogs disappeared a half circle, lying horizontally in the heavens with the bow towards the sun, was formed; its colors were of dazzling brilliancy, and sparks were apparently thrown off similar to those caused by electricity. The display lasted about one hour, and appeared again in the evening when it was less brilliant. During the 25th a low pressure storm appeared over the middle plateau region southeast of Idaho, and general rain prevailed over the eastern part of the middle plateau region on the 25th, 26th, and 27th, no general rain being reported on those dates in Idaho.

METEORS.

Brilliant meteors were reported as follows: 4th, Granbury, Tex; 11th, Green Bay, Wis.; 27th, Southport, N. C. Meteors were also reported as follows: 1st, Monticello, Iowa. 4th, Wilmington, N. C.; Eagle's Mere, Pa. 5th, Leicester, Mass. 9th, Nashville, Tenn. 12th, Vevay, Ind.; Wedgwood, N. Y. 13th, Villa City, Fla.; Beverly, N. J. 16th, Beaver, Utah. 18th, Wilmington, N. C. 21st, Cockrell, Ill.; Meridian, Miss. 26th, State College, Pa.

MIRAGE.

Mirage were observed during the month as follows: 1st, Tribune, Kans. 2d, Tribune, Kans.; Fort Maginnis, Mont. 3d, Hampton, Iowa; Spearfish, S. Dak. 8th, Spearfish, S. Dak. 12th, 15th, 16th, and 18th, Tribune Kans. 22d, Scranton, S. Dak. 28th, Webster and Woonsocket, S. Dak.

Spearfish, S. Dak.: a very fine mirage was observed to the north and northwest of this place at 8 a. m., 3d. High lands along the Belle Fouch for thirty miles or more were raised into plain view, and appeared about two or three miles distant.

SUN SPOTS.

Haverford College Observatory, Pa. (observed by Prof. F. P. Leavenworth):

Date.	Number of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Faculæ.	Definition.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	
Feb., 1890.										
4, 12 m.....	0	0	0	0	0	0	0	0	0	Fair; clouds.
5, 9 a. m ...	0	0	0	0	0	0	0	0	0	Poor; through clouds.
6, 12 m.....	0	0	0	0	0	0	0	0	0	Fair.
7, 10 a. m ...	0	0	0	0	0	0	0	0	0	Very poor; through clouds.
9, 9 a. m ...	0	0	0	0	0	0	0	0	4	Fair.
10, 10 a. m ...	0	0	0	0	0	0	0	0	0	Fair.
11, 2 p. m ...	0	0	0	0	0	0	0	0	0	Fair.
12, 11 a. m ...	0	0	0	0	0	0	0	0	6	Good.
13, 10 a. m ...	0	0	0	0	0	0	0	0	12	Good.
14, 4 p. m ...	0	0	0	0	0	0	0	0	3	Fair.
15, 10 a. m ...	0	0	0	0	0	0	0	0	7	Fair.
16, 12 m.....	0	0	0	0	0	0	0	0	1	Very poor.
17, 10 a. m ...	0	0	0	0	0	0	0	0	6	Fair.
18, 10 a. m ...	0	0	0	0	0	0	0	0	0	Very poor; through clouds.
20, 4 p. m ...	0	0	0	0	0	0	0	0	0	Poor.
21, 10 a. m ...	0	0	0	0	0	0	0	0	5	Fair.
22, 11 a. m ...	0	0	0	0	0	0	0	0	0	Poor.
26, 10 a. m ...	0	0	0	0	0	0	0	0	6	Fair.

Mr. C. E. Buzzell, Leaf River, Ill: solar observations were made only upon sixteen days during February, 1890. The group of January was seen February 1st, and it was the only one noted during the month. Prominent faculæ were seen on west limb on 15th.

Mr. M. A. Veeder, Lyons, N. Y.: no spots were seen during the month. Faculæ appeared by rotation on the 2d and 15th. Observations were poor or lacking on the 1st, 3d, 4th, 5th, 7th, 9th, 10th, 12th, 14th, 17th to 28th.

Mr. John W. James, Riley, Ill., and Mr. H. D. Gowey, North Lewisburgh, Ohio, report that no sun spots were seen during the month.

VERIFICATIONS.

FORECASTS FOR 24 HOURS IN ADVANCE.

[Verifications made by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams, chief clerk of the Forecast Division.]

The forecasts for districts east of the Rocky Mountains for Febuary, 1890, were made by 2d Lieutenant W. A. Glassford, Signal Corps, and those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps.